

Environmental Protection Agency

Pt. 60, App. A-3, Meth. 5H

8.11.2.1 Container Nos. 1 and 1A. Treat the two filters according to the procedures outlined in Method 5, Section 8.7.6.1. The filters may be stored either in a single container or in separate containers.

8.11.2.2 Container No. 2. Same as Method 5, Section 8.7.6.2, except that the container should not be sealed until the impinger rinse solution is added (see Section 8.10.2.4).

8.11.2.3 Container No. 3. Treat the impingers as follows: Measure the liquid which is in the first three impingers to within 1-ml by using a graduated cylinder or by weighing it to within 0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas. Transfer the water from the first, second, and third impingers to a glass container. Tighten the lid on the sample container so that water will not leak out.

8.11.2.4 Rinse impingers and graduated cylinder, if used, with acetone three times or more. Avoid direct contact between the acetone and any stopcock grease or collection of any stopcock grease in the rinse solutions. Add these rinse solutions to sample Container No. 2.

8.11.2.5 Container No. 4. Same as Method 5, Section 8.7.6.3

8.12 Sample Transport. Whenever possible, containers should be transferred in such a way that they remain upright at all times.

NOTE: Requirements for capping and transport of sample containers are not applicable if sample recovery and analysis occur in the same room.

9.0 Quality Control

9.1 Miscellaneous Quality Control Measures.

Section	Quality control measure	Effect
8.2	Sampling system bias check	Ensures that bias introduced by measurement system, minus analyzer, is no greater than 3 percent of span.
8.2	Analyzer zero and calibration drift tests	Ensures that bias introduced by drift in the measurement system output during the run is no greater than 3 percent of span.
8.5, 10.1, 12.13	Sampling equipment leak-check and calibration; proportional sampling rate verification.	Ensures accurate measurement of stack gas flow rate, sample volume.
10.1	Analytical balance calibration	Ensures accurate and precise measurement of collected particulate.
10.3	Analyzer calibration error check	Ensures that bias introduced by analyzer calibration error is no greater than 2 percent of span.

9.2 Volume Metering System Checks. Same as Method 5, Section 9.2.

10.0 Calibration and Standardization

NOTE: Maintain a laboratory record of all calibrations.

10.1 Volume Metering System, Temperature Sensors, Barometer, and Analytical Balance. Same as Method 5G, Sections 10.2 through 10.5, respectively.

10.2 SO₂ Injection Rotameter. Calibrate the SO₂ injection rotameter system with a soap film flowmeter or similar direct volume measuring device with an accuracy of 2 percent. Operate the rotameter at a single reading for at least three calibration runs for 10 minutes each. When three consecutive calibration flow rates agree within 5 percent, average the three flow rates, mark the rotameter at the calibrated setting, and use the calibration flow rate as the SO₂ injection flow rate during the test run. Repeat the rotameter calibration before the first certification test and semiannually thereafter.

10.3. Gas Analyzers. Same as Method 6C, Section 10.0.

11.0 Analytical Procedure

11.1 Record the data required on a sheet such as the one shown in Figure 5H-4.

11.2 Handle each sample container as follows:

11.2.1 Container Nos. 1 and 1A. Treat the two filters according to the procedures outlined in Method 5, Section 11.2.1.

11.2.2 Container No. 2. Same as Method 5, Section 11.2.2, except that the beaker may be smaller than 250-ml.

11.2.3 Container No. 3. Note the level of liquid in the container and confirm on the analysis sheet whether leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Determination of sample leakage is not applicable if sample recovery and analysis occur in the same room. Measure the liquid in this container either volumetrically to within 1-ml or gravimetrically to within 0.5 g. Transfer the contents to a 500-ml or larger separatory funnel. Rinse the container with water, and add to the separatory funnel. Add 25-ml of dichloromethane to the separatory funnel, stopper and vigorously shake 1 minute, let

separate and transfer the dichloromethane (lower layer) into a tared beaker or evaporating dish. Repeat twice more. It is necessary to rinse Container No. 3 with dichloromethane. This rinse is added to the impinger extract container. Transfer the remaining water from the separatory funnel to a tared beaker or evaporating dish and evaporate to dryness at 104 °C (220 °F). Desiccate and weigh to a constant weight. Evaporate the combined impinger water extracts at ambient temperature and pressure. Desiccate and weigh to a constant weight. Report both results to the nearest 0.1 mg.

11.2.4 Container No. 4. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance.

11.2.5 Acetone Blank Container. Same as Method 5, Section 11.2.4, except that the beaker may be smaller than 250 ml.

11.2.6 Dichloromethane Blank Container. Treat the same as the acetone blank.

11.2.7 Water Blank Container. Transfer the water to a tared 250 ml beaker and evaporate to dryness at 104 °C (220 °F). Desiccate and weigh to a constant weight.

12.0 Data Analysis and Calculations

Carry out calculations, retaining at least one extra significant figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

12.1 Nomenclature.

a = Sample flow rate adjustment factor.

BR = Dry wood burn rate, kg/hr (lb/hr), from Method 28, Section 8.3.

B_{ws} = Water vapor in the gas stream, proportion by volume.

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

E = Particulate emission rate, g/hr (lb/hr).

ΔH = Average pressure differential across the orifice meter (see Figure 5H-1), mm H₂O (in. H₂O).

L_a = Maximum acceptable leakage rate for either a post-test leak-check or for a leak-check following a component change; equal to 0.00057 cmm (0.020 cfm) or 4 percent of the average sampling rate, whichever is less.

L_i = Individual leakage rate observed during the leak-check conducted before a component change, cmm (cfm).

L_p = Leakage rate observed during the post-test leak-check, cmm (cfm).

m_n = Total amount of particulate matter collected, mg.

M_a = Mass of residue of solvent after evaporation, mg.

N_C = Grams of carbon/gram of dry fuel (lb/lb), equal to 0.0425.

N_T = Total dry moles of exhaust gas/kg of dry wood burned, g-moles/kg (lb-moles/lb).

PR = Percent of proportional sampling rate.

P_{bar} = Barometric pressure at the sampling site, mm Hg (in.Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in.Hg).

Q_{std} = Total gas flow rate, dscm/hr (dscf/hr).

S₁ = Concentration measured at the SO₂ analyzer for the first 10-minute interval, ppm.

S_i = Concentration measured at the SO₂ analyzer for the "ith" 10 minute interval, ppm.

T_m = Absolute average dry gas meter temperature (see Figure 5H-3), °K (°R).

T_{std} = Standard absolute temperature, 293 °K (528 °R).

V_a = volume of solvent blank, ml.

V_{aw} = Volume of solvent used in wash, ml.

V_{lc} = Total volume of liquid collected in impingers and silica gel (see Figure 5H-4), ml.

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

V_{m(std)} = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

V_{mi(std)} = Volume of gas sample measured by the dry gas meter during the "ith" 10-minute interval, dscm (dscf).

V_{w(std)} = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

W_a = Weight of residue in solvent wash, mg.

Y = Dry gas meter calibration factor.

Y_{CO} = Measured mole fraction of CO (dry), average from Section 8.2, g/g-mole (lb/lb-mole).

Y_{CO2} = Measured mole fraction of CO₂ (dry), average from Section 8.2, g/g-mole (lb/lb-mole).

Y_{HC} = Assumed mole fraction of HC (dry), g/g-mole (lb/lb-mole); = 0.0088 for catalytic wood heaters; = 0.0132 for non-catalytic wood heaters; = 0.0080 for pellet-fired wood heaters.

10 = Length of first sampling period, min.

13.6 = Specific gravity of mercury.

100 = Conversion to percent.

θ = Total sampling time, min.

θ₁ = Sampling time interval, from the beginning of a run until the first component change, min.

12.2 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop. See data sheet (Figure 5H-3).

12.3 Dry Gas Volume. Same as Method 5, Section 12.3.

12.4 Volume of Water Vapor.

$$V_{w(std)} = K_2 V_{lc} \quad \text{Eq. 5H-1}$$

Where:

K₂ = 0.001333 m³/ml for metric units.

K₂ = 0.04707 ft³/ml for English units.

12.5 Moisture Content.

Environmental Protection Agency

Pt. 60, App. A-3, Meth. 5H

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}} \quad \text{Eq. 5H-2}$$

12.6 Solvent Wash Blank.

$$W_a = \frac{M_a V_{aw}}{V_a} \quad \text{Eq. 5H-3}$$

12.7 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from containers 1, 2, 3, and 4 less the appropriate solvent blanks (see Figure 5H-4).

NOTE: Refer to Method 5, Section 8.5 to assist in calculation of results involving two filter assemblies.

12.8 Particulate Concentration.

$$C_s = \frac{0.001g}{mg} \frac{m_n}{V_{m(std)}} \quad \text{Eq. 5H-4}$$

12.9 Sample Flow Rate Adjustment.

$$a = \frac{S_i}{S_i} \quad \text{Eq. 5H-5}$$

12.10 Carbon Balance for Total Moles of Exhaust Gas (dry)/kg of Wood Burned in the Exhaust Gas.

$$N_T = \frac{K_3 N_C}{Y_{CO_2} + Y_{CO} + Y_{HC}} \quad \text{Eq. 5H-6}$$

Where:

$K_3 = 1000 \text{ g/kg}$ for metric units.

$K_3 = 1.0 \text{ lb/lb}$ for English units.

NOTE: The NO_x/SO_x portion of the gas is assumed to be negligible.

12.11 Total Stack Gas Flow Rate.

$$Q_{sd} = K_4 N_T BR \quad \text{Eq. 5H-7}$$

Where:

$K_4 = 0.02406 \text{ dscm/g-mole}$ for metric units.

$K_4 = 384.8 \text{ dscf/lb-mole}$ for English units.

12.12 Particulate Emission Rate.

$$E = C_s Q_{sd} \quad \text{Eq. 5H-8}$$

12.13 Proportional Rate Variation. Calculate PR for each 10-minute interval, i , of the test run.

$$PR = \frac{\theta S_i V_{mi(std)}}{N \sum_{i=1}^{10} [S_i V_{mi(std)}]} \times 100 \quad \text{Eq. 5H-9}$$

12.14 Acceptable Results. If no more than 15 percent of the PR values for all the intervals fall outside the range $90 \text{ percent} \leq PR \leq 110 \text{ percent}$, and if no PR value for any interval falls outside the range $75 \leq PR \leq 125 \text{ percent}$, the results are acceptable. If the PR values for the test runs are judged to be unacceptable, report the test run emission results, but do not include the test run results in calculating the weighted average emission rate, and repeat the test.

13.0 Method Performance. [Reserved]

14.0 Pollution Prevention. [Reserved]

15.0 Waste Management. [Reserved]

16.0 References

Same as Method 5G, Section 17.0.

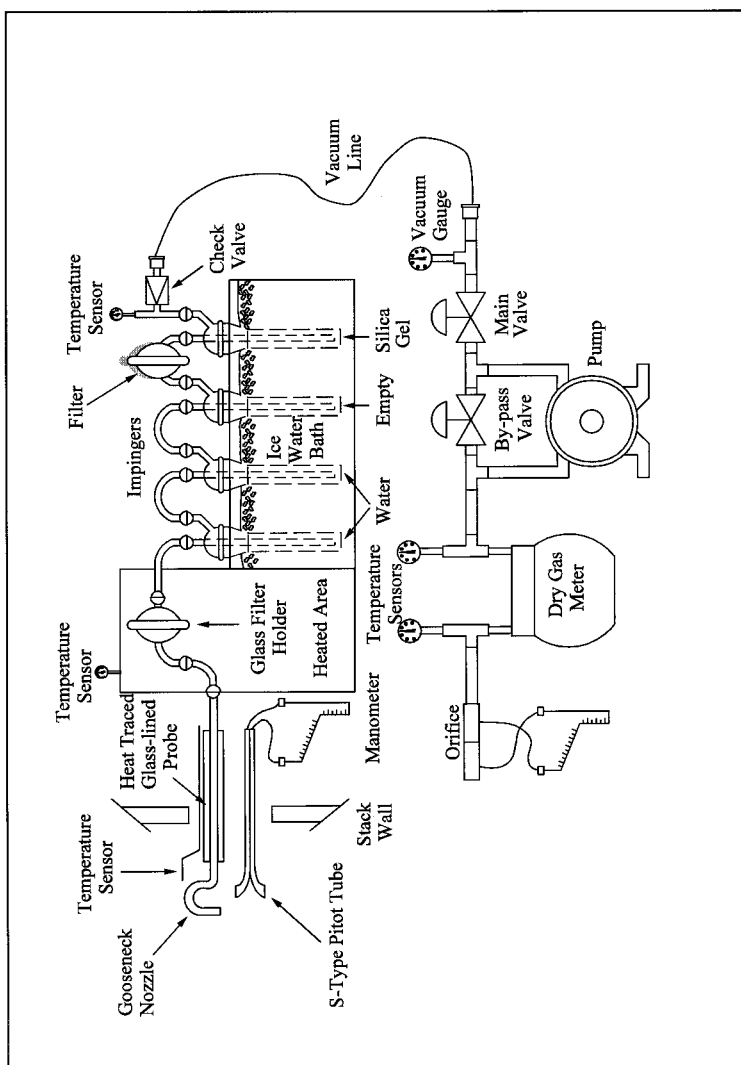


Figure 5H-1. Sampling Train.

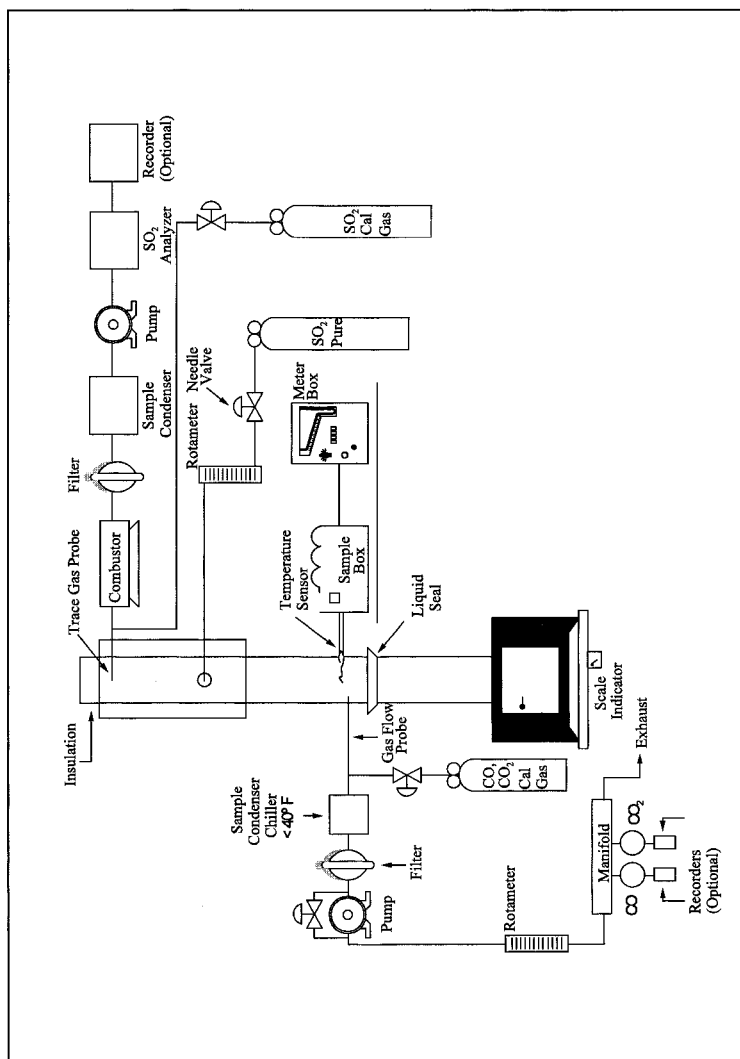


Figure 5H-2. Test System Schematic.